

What is claimed is:

1. A deflectable, high torque, balloon catheter comprising:
 - a flexible catheter shaft having a distal shaft section, a proximal shaft section and a middle shaft section, wherein each shaft section has a distal end and a proximal end, said flexible catheter shaft having at least one lumen extending between the distal end of the distal shaft section and the proximal end of the proximal shaft section;
 - a handle secured at the proximal end of the proximal shaft section;
 - a balloon attached at the distal shaft section; and
 - at least one shaft section comprising a deflectable, high torque transmission assembly for transmitting bending and torque properties along said at least one shaft section, said deflectable, high torque transmission assembly comprising a slit tubular element that has a plurality of slits on said slit tubular element, wherein arrangement of said plurality of slits with respect to a longitudinal axis of said shaft section is selected from the group consisting of an angled slit, and a combination of a perpendicular slit and an angled slit, wherein said plurality of slits with respect to a longitudinal axis of said shaft section are arranged in a plurality of rows parallel and staggered with respect to each other.
2. The deflectable, high torque, balloon catheter of claim 1, wherein each of the plurality of slits has a slit starting point at an outer surface of said shaft section and two slit terminating points at said outer surface away from the slit starting point, each slit terminating point being coupled with a small circular hole.
3. The deflectable, high torque, balloon catheter of claim 1, wherein the slit tubular element of the deflectable, high torque transmission assembly is embedded within an elastic membrane.
4. The deflectable, high torque, balloon catheter of claim 1, wherein the slit tubular element of the deflectable, high torque transmission assembly is covered on an external side or on an internal side of said slit tubular element by an elastic membrane.

5. The deflectable, high torque, balloon catheter of claim 1, wherein the tubular element of the deflectable, high torque transmission assembly contains rows of longitudinal anchors acting as channels for steering wires to deflect said slit tubular element in different directions.
6. The deflectable, high torque, balloon catheter of claim 1, wherein the balloon material is selected from the group consisting of silicone, latex, polyurethane, thermoplastic elastomer, polyethylene, cross-linked polyethylene, permeable membrane, and polyethylene terephthalate.
7. The deflectable, high torque, balloon catheter of claim 3, wherein the elastic membrane is selected from the group consisting of silicone, latex, polyurethane, thermoplastic elastomer, polyethylene balloon, cross-linked polyethylene balloon, permeable membrane, and polyethylene terephthalate balloon.
8. The deflectable, high torque, balloon catheter as in claim 1, wherein the slit tubular element is made of a material selected from the group consisting of platinum, stainless steel, nitinol, gold, silver, iridium, tungsten, and an alloy of their mixture.
9. The deflectable, high torque, balloon catheter as in claim 1, further comprising at least one electrode mounted on the catheter shaft that is adjacent to the slit tubular element.
10. The deflectable, high torque, balloon catheter as in claim 9, further comprising a RF energy generator and an electrical conductor secured to said RF energy generator and said slit tubular element, wherein the electrical conductor is adapted for transmitting RF energy from said RF energy generator to the at least one electrode or the slit tubular element.

11. The deflectable, high torque, balloon catheter as in claim 1, further comprising a steering mechanism on the handle for deflecting the distal shaft section of the flexible catheter shaft.
12. A deflectable, high torque, balloon catheter comprising:
 - a flexible catheter shaft having a distal shaft section, a proximal shaft section and a middle shaft section, wherein each section has a distal end and a proximal end, said flexible catheter shaft having at least one lumen extending between the distal end of the distal shaft section and the proximal end of the proximal shaft section;
 - a handle secured at the proximal end of the proximal shaft section;
 - a balloon attached at the distal shaft section; and
 - at least one shaft section comprising a deflectable, high torque transmission assembly for transmitting bending and torque properties along said at least one shaft section, said high torque transmission assembly comprising a slit tubular element that has at least one continuously spiraling slit on said slit tubular element and has sufficient bending and torque properties ensuring that a substantial fraction of the bending, rotational and displacement forces provided along said at least one shaft section are translated to bending, rotational and displacement forces at the distal end of said shaft section of the flexible catheter shaft, wherein the slit tubular element has a plurality of parallel slit members resulting from the at least one continuously spiraling slit, wherein at least a portion of at least one pair of adjacent slit members is secured together, wherein said tubular element has rows of longitudinal anchors acting as channels for steering wires to deflect said slit tubular element in different directions.
13. The deflectable, high torque, balloon catheter of claim 12, wherein the slit tubular element of the deflectable, high torque transmission assembly is embedded within an elastic membrane.
14. The deflectable, high torque, balloon catheter of claim 12, wherein the slit tubular element of the deflectable, high torque transmission assembly is covered by an elastic membrane, the

elastic membrane separating an exterior of said slit tubular element from an interior of said slit tubular element.

15. The deflectable, high torque, balloon catheter of claim 13, wherein the elastic membrane is selected from the group consisting of silicone, latex, polyurethane, polyethylene balloon, cross-linked polyethylene balloon, permeable membrane, and polyethylene terephthalate balloon.
16. The deflectable, high torque, balloon catheter as in claim 12, wherein the slit tubular element is made of a material selected from the group consisting of platinum, stainless steel, Nitinol, gold, silver, iridium, tungsten, and their mixture thereof.
17. The deflectable, high torque, balloon catheter as in claim 12, further comprising at least one electrode mounted on the flexible catheter shaft that is adjacent to the slit tubular element.
18. The deflectable, high torque, balloon catheter as in claim 17, further comprising a RF energy generator and an electrical conductor secured to said RF energy generator and said slit tubular element, wherein the electrical conductor is adapted for transmitting RF energy from said RF energy generator to the at least one electrode or the slit tubular element.
19. The deflectable, high torque, balloon catheter as in claim 18, further comprising a steering mechanism on the handle for deflecting the distal shaft section of the flexible catheter shaft.
20. A method for operating a deflectable, high torque, balloon catheter within a body of a patient, the deflectable, high torque catheter comprising a flexible catheter shaft having a plurality of shaft sections, wherein at least one shaft section comprises a deflectable, high torque transmission assembly for transmitting bending and torque properties along said at least one shaft section, said deflectable, high torque transmission assembly comprising a slit tubular element that has a plurality of slits on said slit tubular element, wherein arrangement of said

plurality of slits with respect to a longitudinal axis of said shaft section is selected from the group consisting of an angled slit, a curved slit, and a combination of a perpendicular slit and an angled slit, wherein said plurality of slits with respect to a longitudinal axis of said shaft section are arranged in a plurality of rows parallel and staggered with respect to each other, wherein said tubular element has rows of longitudinal anchors acting as channels for steering wires to deflect said slit tubular element in different directions;

the method comprising the steps of:

- (a) percutaneously introducing the deflectable, high torque, balloon catheter through an opening of the body of the patient;
- (b) approaching the deflectable, high torque, balloon catheter to a target tissue of the patient by transmitting bending, rotational and displacement forces through the at least one shaft section of the flexible catheter shaft; and
- (c) positioning the deflectable, high torque balloon catheter at the target tissue for diagnostic study by use of balloon for blocking a vessel ostium, followed by contrast medium injection through its distal tip, and/or therapeutic tissue treatment with radiofrequency or low energy defibrillating energy.